OH-94-3 Supplied Breathing Air Systems Maintenance Found to be Inadequate

OFFICE OF HEALTH

HEALTH HAZARD ALERT

Assistant Secretary for Environment, Safety and Health

U. S. Department of Energy Washington, D.C.
Issue 94-3 May 1994

Supplied Breathing Air Systems Maintenance Found to be Inadequate

Several deaths have occurred in general industry because of inadequately maintained or improperly designed breathing air systems. Recent unusual occurrences at the Department of Energy (DOE) management & operating (M&O) facilities highlight the need for a review of breathing air supply systems at all DOE facilities. When a respirator's air line is connected to a source of inert gas rather than to breathable air, the victim has little or no warning before losing consciousness.

Eleven fatalities that occurred nationwide during 1984 to 1988 were recently reviewed by National Institute for Occupational Safety and Health (NIOSH).

These fatalities resulted from the inadvertent connection of air-line respirators to inert gas supplies.

Connecting an air-line respirator supply hose to a line that normally carried inert gas caused seven of the eleven deaths. A supplied-air respirator, whether configured with a suit, hood, or face piece, must have a hose with couplings that are incompatible with couplings used for any other gas. Coupling compatibility was indicated as the major factor in allowing these workers to connect to an irrespirable gas. These deaths would have been prevented if the facility used a style of detachable coupling for breathing air that was incompatible with the fittings for all other gas sources at the facility.

Four of the eleven deaths were caused by leakage or backfill of inert gas into a line that normally carried breathable air, rather than a direct connection to an inert gas supply. Supervisory in attention was indicated by NIOSH was indicated in attention as the major factor in the inappropriate supply of irrespirable has to the respirators worn by these workers. These other four deaths would have been prevented if the facility followed a strict policy to never fill air lines with any other gas. That is, breathing air lines should be used exclusively for breathing air, and the detachable couplings on the lines should be unique to that system.

Currently DOE M&O facilities are mandated by 5480.4 to follow Occupational Safety and Health Administration (OSHA) regulations and the American National Standards Institute (ANSI) Z88.2 standard. Both

OSHA and ANSI require exclusive couplings for breathing air. The Office of Health Physics and Industrial Hygiene (EH-41) is now developing an order on respiratory protection. One consideration for the order is specifying a make and model of connection as being exclusively for use with breathing air systems. An exclusive color coding of breathing-air lines is also a consideration.

An asphyxiation by inert gas from a different source was investigated by OSHA in 1990. In this case, the worker breathed from a cylinder labeled breathing air, but the air was intended to be reconstituted from pure nitrogen and oxygen. Apparently, a mistake was made and less than 1 percent oxygen was added to the cylinder. The new ANSI standard, Z88.2-1992, now required that every cylinder filled with reconstituted air be tested for oxygen concentration. This may be done either by the cylinder filler or by the user. A similar requirement is made for cylinders of breathing air that are filled by a supplier who also fills cylinders with other gases. A supplied-air respirator required Grade D breathable air.

The need to an assured supply of breathing air was indicated by a recent unusual occurrence at a DOE facility. In this facility, the dedicated breathing air compressor, which failed, had two backup supplies. One of the backup supplies, another breathing air compressor, was out of service for repairs. The other, a breathing-air cart with cylinders of compressed breathing air, was manually switched into the line that supplied air to the workers in air-supplied suits. This provided sufficient air for breathing until the workers could leave the contaminated area; however, it was deficient in two respects: (1) the carts manifold restricted flow to 4 cfm, which is below the 6 cfm required in the suit's approval to prevent contamination, and (2) manual switching of the air supply was used. This required that a standby person be close enough to hear the alarm, and to then turn the correct valves, which would be unreliable since this was in a hearing protection required area, and to then turn the correct valves. An automatic switching system would be more reliable.

The need for dedicated breathing air equipment was indicated in another recent unusual occurrence. Here, a transportable breathing-air compressor system combined with a motor/generator was properly designed, but it had been loaned out and used for operating tools. The tool operator disconnected the low pressure alarm and changed the disconnect fittings. When it was later loaned for breathing air purposed, the disconnect fittings were changed, but the wiring changes to the alarm were missed. An inadequate motor/generator was then supplied so that the compressor started with zero air-reservoir pressure, but could not restart with pressure in the reservoir. As a result, initially the compressor started and pumped up the reservoir to 180 pounds per square psig, and two workers donned their respirator hoods and entered a large contaminated tank. When the air pressure in the reservoir dropped to 190 psig, the motor/generator tried to start the compressor but failed. When the pressure dropped to 100 psig, the alarm should have sounded, but it was disconnected. The workers were barely able to safely leave the tank after they detected that the air pressure was inadequate. Here, the system was designed adequately, but the standard operating procedure and administrative controls were lacking.

In summary, breathing air-supply equipment (this includes: couplings, piping, reservoirs, cylinders, and compressors) should be used exclusively for breathing air, and switching to the reservoir should be automatic. It is required that: (1) couplings be incompatible with other gas couplings, (2) there is an air reservoir of sufficient capacity on the systems, (3) every cylinder of breathing air be tested for oxygen if received from certain suppliers, and (4) a safety analysis be performed on each breathing air-system.

This Health Hazard Alert is one in a series of routine publications issued by the Office of Health to share data from health studies throughout the DOE complex. For more information contact: Dr. Terry L. Thomas, Director, Health Coordination and Communication Division, Office of Epidemiology and Health Surveillance, U. S. Department of Energy, Washington, D.C. 20585; Telephone FTS 233-5328, Commercial (301) 353-5328.